Fluid Merging Viscosity Measurements (FMVM)

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Objective: Measure viscosity of highly viscous substances in containerless conditions

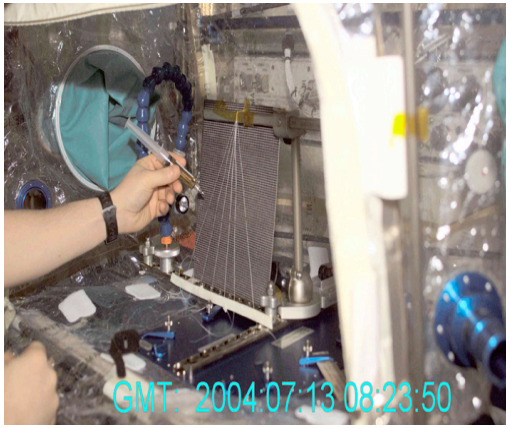
Significance: Verification and validation of a method for viscosity measurement using the coalescence of two liquid drops.

Data provided could give insight into the behavior of glasses for potential fabrication on long duration missions. Coalescence of liquid drops also influences liquid phase sintering.

Approach: Drop coalescence in microgravity occurs by unconstrained fluid motion and is only a function of the surface tension and viscosity.

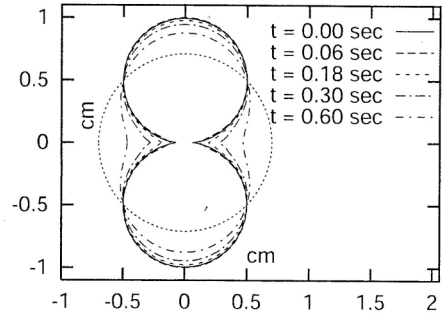
Drops can be "free floated" eliminating the problem with constrained drops and liquid bridge formation.

Mike Fincke preparing for the FMVM testing at the Microgravity Work Area



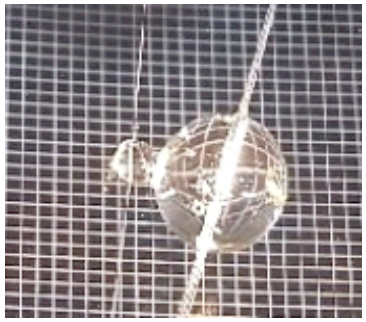
Deployment of a drop of liquid onto Nomex thread

FMVM modeling



Simulation of coalescence with an assumed viscosity

FMVM on ISS



0.5 ml and 8 ml drops of silicone oil coalesing

Statistics: Drop coalescence experiments performed on 7 liquids – viscosities ranging 1,500-100,000 cP. Approximately 5 different diameter droplets per liquid

Results: All except glycerine (viscosity too low) deployed and coalesced as per procedure

Rate of coalescence is related to viscosity

Significant Findings: Contact neck radius calculated by boundary element method agrees with ISS results

Contact neck radius growth follows a square root time dependence

Conclusions: Meaningful science can be obtained on ISS with minimal resources and with short lead time.

FMVM is a viable method for the determination of viscosity of liquids in low gravity